

Where do you want to go today? Inquiry-based learning and technology integration

Providing a choice of subjects to study and a range of new technologies with which to study them produced positive results in two programs.

Alisha and Chloe (all children's names are pseudonyms) breathlessly shared the results of their inquiry-based learning project.

We wanted to learn about hippotherapy because we like horses, and we wanted to do a service project, and we like to work with the special ed. kids, so this way we could combine all of our interests. In our class, you propose a project and then plan the exploration. You can use computers and books and live resources like people to help you find the information; then you have to create stuff and do something. So we used the Internet to find out about how working with horses can help kids with special needs to work on all kinds of skills, and we interviewed someone who works at a special stable, and then we made a brochure about it, and then we took interested kids to a place where they do it.

Next, it was Josh's turn.

My grandfather had Alzheimer's so I wanted to learn about it. I really got interested in the brain, so I decided to do an inquiry on diseases of the brain. I interviewed experts online and used the Internet and books. I created an interactive multimedia presentation where I presented information about the diseases of the brain, and then there were case studies where based on the symptoms, students had to determine what the appropriate diagnostic test would be to give. If they picked the wrong test, it meant they hadn't understood all of the information about the particular disease, so they had to go back and reread. That was my best project. I really learned a lot, and I think the other kids did, too.

A current U.S. television advertising campaign asks, "Where do you want to go today?"

With the addition of various technology-based resources to classrooms, the same question could be posed to elementary and middle school children. Computers and Internet technologies are by no means a magical solution to raising educational achievement in our schools, but they do provide an array of new opportunities for accessing information and promoting significant learning among students. We have explored those opportunities through technology-enhanced, inquiry-based learning projects. School has traditionally focused on having children answer questions; inquiry-based learning turns that on its head, involving children in formulating engaging questions and then participating in various language and literacy experiences to answer them. In other words, questions act as the vehicle to understanding.

In this article we describe two projects that incorporated inquiry into urban educational settings. In both of these instances, technology played a key role in allowing children to conduct their inquiries and in affecting their learning outcomes. We discuss what we learned as a result of implementing these projects. We offer practical considerations for employing technology-enhanced inquiry in the classroom and discuss broader theoretical issues related to the contribution of technology to literacy learning and motivation when students ask their own significant learning questions, which, in the long run, lead them to more questions.

Inquiry-based learning and how it functions as part of a literacy program

Inquiry-based learning is a way of thinking about teaching and learning. Grabe and Grabe (2000) defined it as both a methodology and a philosophy:

Inquiry involves finding sources of information appropriate to a task, working to understand the information resources and how they relate to the task, and then, in those cases for which some action is expected, applying this understanding in a productive way. (p. 21)

Students select a topic of interest to research; they formulate questions about the topic; gather, sift, and synthesize information; and finally *do something* with it. The last component is often the most difficult aspect for many students, but it is what distinguishes inquiry-based projects from typical school research projects. Inquiry involves more than reporting on a topic, it requires students to move beyond the Who, What, Where, When questions that so often form the basis of classroom research projects. When inquiry-based learning is used well, students engage in “What does this mean, and how can I use this information?” questions. They are pushed to expand their understandings by creating new connections. The focus on inquiry heightens involvement and motivation for reading and writing and for reading and writing instruction. Couching literacy activities in the context of something meaningful and interesting to students themselves increases the chance for success.

Inquiry also differs from thematic teaching, as Short et al. (1996) suggested:

Instead of using the theme as an excuse to teach science, social studies, mathematics, reading, and writing, these knowledge systems and sign systems become tools for inquiry—exploring, finding, and researching students’ own questions. Curriculum does not focus on activities and books, but on inquiry. (p. 11)

The most successful inquiry projects emerge from topics that are of real interest to the students. These topics may be derived from themes studied as a class, but if so, it is imperative that students have a choice of topics about which they truly wonder and care.

There are a number of ways that inquiry is approached with students. Short, Harste, and

Burke (1996), for example, believed that inquiry *is* the curriculum and differentiate it from theme-based units. The “Authoring Cycle”—their curricular framework for inquiry—is a recursive process that begins with students’ prior knowledge and interests and leads to students’ taking action and learning. They believed children should be involved in this inquiry cycle throughout the entire school day and year.

Our approach in engaging children in inquiry has been more focused, employing it as one facet of an overall curriculum. In our view, inquiry-based projects complement other components of the literacy program such as instruction in comprehension, word study, and writing. In other words, rather than inquiries being what children do virtually all day, there is an identifiable time when students work on their inquiries.

The projects we refer to in this article happen to be after-school and summer programs. But in other settings where we have been involved (e.g., Owens, 1997), technology-based inquiry was part of the regular school day. We mention this in order to provide a picture of how inquiry-based instruction was implemented in the urban and suburban settings where we have worked with teachers. On the whole, the teachers have opted for inquiry to be one aspect of their day rather than a comprehensive program, even in schools with strong teacher commitment to inquiry-based teaching and adequate materials, technology, and technical support. This seems to stem from the realities of the demands and accountability these teachers experience in their public school settings.

Facets of inquiry-based teaching

Linda Rief (1999) suggested that teachers ask themselves a few key questions in preparation for inquiry-based instruction, “When was the last time I really learned about something in depth? How did I go about learning it? How do I know I know this?” (p. 3). Exploring our own learning motivations and processes helps us to examine our teaching. In thinking about questions like those Rief posed, many teachers conclude that being interested in the topic, having a plan for how to research it, and having a purpose for engaging in the project (e.g., the “do something” part), are integral parts of their own learning and thus need to play a larger role in their teaching. We have found that effective

implementation of inquiry-based teaching is characterized by a number of factors.

Student curiosity. Perhaps most fundamental is a classroom environment that honors and stimulates curiosity. Brenda Kraber, a 23-year veteran of teaching who has been using an inquiry-based model in her fourth-, fifth-, and sixth-grade classrooms for the past 7 years, notes,

We are constantly creating something new; we're always learning about new topics—rather than having everyone do an endangered animal project every year, each person follows his or her own path. I've learned about things I never even knew existed. Because I'm learning along with the kids, there is a real air of excitement in the classroom. Last year I had never heard of hippotherapy. Now I'm an expert in it.

Making inquiry visible. In an inquiry-based classroom, it is helpful for teachers to share their own research, modeling how one engages in higher level processing of information. By sharing their own inquiry projects, teachers demonstrate for students a number of important things:

- How to formulate questions that move beyond the literal level of understanding,
- how to collect information from a wide variety of resources, and
- how to use the information in a meaningful way.

The importance of topics and questions. Forming the question(s) that one will attempt to answer plays a key role in a successful inquiry. We have found that more than any other single factor, a student's topic choice, and the actual questions associated with the topic, affect how well the inquiry turns out. There seem to be three dimensions of importance in the choice of topic: interest in the topic, prior knowledge of the topic, and the nature of the topic itself.

When children choose a topic of interest, they tend to remain engaged during the length of the study (Harvey, 1998). Students in Mrs. Kraber's class enjoy the freedom of topic selection but also are aware of the level of responsibility needed to participate in inquiry-based learning. Brian, a sixth grader, put it this way:

It's nice to follow your interests, but you have to set goals and get organized and track down good sources. You have to find at least three sources that say the same thing because a lot of stuff on the Internet can be wrong.

Also, we have found that if children have some prior knowledge related to their topic, their inquiries tend to turn out better than if they are starting from scratch. In practical terms this means that we often require students to identify 10 things they know about a topic before they can begin an inquiry on it.

The nature of the topic itself is often a difficulty for students. They frequently run into problems with chosen topics that are difficult to study because they are too broad, too narrow, or just not clearly defined. This is one area where appropriate teacher guidance and opportunities for students to reflect on topics can help. For example, students in Mrs. Kraber's class complete a "Project Proposal" that requires them to choose from six types of project (Communication, Invention, Decision Making, Service, Scientific Investigation, Simulation) and to show how the topic selected passes the "Who Cares?" test. The Who Cares test requires the student to write a series of questions indicating the level of information that will be sought. Students may also define their inquiry more clearly through the use of King's (1991) "question stems." These include the following: How is ____ related to ____?; What is a new example of ____?; What are some possible solutions for the problem of ____?; Explain why ____; What do you think would happen if ____?; Why is ____ important? These stems help students to push their thinking beyond literal details and into more intriguing content.

For example, Andre, a fifth grader, wanted to conduct an inquiry about football. His initial questions were primarily information seeking (Martinello & Cook, 2000): When was football invented? Who invented it? Where was it invented? What was the first team's name? What are the rules? What equipment is used? Which team has won the most Super Bowls? Through appropriate teacher modeling and scaffolding, he was able to add data synthesis and evaluation questions such as these: How is football related to games played in other countries? How has the game of football changed since it was invented? What causes the most common football injury? How do football players' salaries compare to salaries of baseball players and basketball players? Why is football such a popular sport to watch? Why is the XFL [Extreme Football League] having a hard time catching on? Because there was potentially intriguing

information and analysis that could result from these questions, the “Who Cares” test was passed. But the “do something” component was still missing.

Andre was encouraged to use another technique to look at the topic through various perspectives. This takes the form of asking questions about the topic from different disciplines or exploring it through the eyes of someone in a particular profession. Examples include the following: What would be a good science question (math question, history question) related to this topic? What kind of question would a doctor (lawyer, artist, banker, mother, construction worker) ask about this topic? Because Andre had a relative who sustained a serious injury in a football game, the “What question would a doctor ask about this topic” stimulated his thinking. He decided to focus on the “common injuries” information and subsequently created an Invention inquiry centered on the stem question “What are some possible solutions for the problem of common football injuries?” He explored potential adaptations in the rules of the game and the equipment used. His Microsoft PowerPoint presentation incorporated slow motion video clips of bone crunching encounters from football games and recommendations for how modifications in safety equipment (represented through diagrams) could lessen the occurrence of these injuries.

Although students play an important part in the decision making in an inquiry-based classroom, topic choice should not be considered completely a student-driven endeavor. Teachers can foster inquiries by sparking interest in topics that students may not have even considered on their own. Also, students may not select a certain topic on their own because they lack the prior knowledge about it; however, if the teacher introduces the topic and captures student curiosity, a worthwhile inquiry could result.

In certain situations, it is helpful for teachers to play a more direct role in topic selection by providing themes from which students choose their particular inquiries. This can help ensure that reading matter, technology resources, and other materials are available for students as they engage in the inquiry process. In today’s standards-driven curricular world, theme selection also helps teachers align students’ inquiries with the school’s curriculum. In the summer inquiry-based literacy and technology program that we

implemented, themes had to be teacher-selected in order to preview and purchase reading materials, secure community mentors, and more important, to generate interest so students would enroll in the program.

If themes must be selected, it is important that they be broad and interest students. For example, in preparation for The Extra Edge program described later, we asked approximately 70 middle-school-aged students to write about one topic of interest that they would like to study if given the opportunity. We told them to imagine that they would be able to study the topic extensively through reading, talking to experts, taking field trips, and creating “something” to teach others about what they learned. The students’ responses fit into 10 areas of study. We ended up selecting four themes from these areas that we thought would not only capture the students’ interest, but also would have age-appropriate reading materials and Internet sites as well as the possibility for community partnerships. Students enrolled in the theme of their choice and then developed their inquiry questions within those themes.

Facilitate the process of gathering and presenting information. An inquiry-based approach may benefit students of all ability levels, but students who have been unsuccessful in school are often particularly well served. Baum, Renzulli, and Hebert (1994) found that student-centered inquiry projects have the potential to reverse patterns of underachievement in students. They noted the importance of the teacher in facilitating this reversal. Teachers who took the time to get to know the students and their interests, used their time with the students to facilitate the inquiry process rather than counsel them regarding their underachievement, provided resources when the students reached a roadblock, and gave opportunities for the students to share their projects with others had students who improved academically during the year of the study and in the following year. Validating or creating student interest, guiding them through the framework of the process, and providing resources when necessary may offer the support students need to succeed.

Technology and inquiry. A final factor that we found to be particularly effective in implementing inquiry-based teaching is the use of technology, particularly computer- and Internet-related technologies. We have seen such tech-

nologies motivate and maintain student interest, provide unique sources and even types of information, and afford opportunities for extending the nature of students' reading and writing processes into multimedia composition and comprehension.

Technology as cognitive support for inquiry

A predominant view of technology in education during the past two decades has focused on computers as "tools." There is disagreement on the definition of tool, as well as discussion centering on how, why, and even if these tools should be integrated into the classroom (Cordes & Miller, 2000; Jonassen & Reeves, 1996; Zajonc, 1985). Our purpose in this article is not to engage in this debate; technology is here and its integration into the classroom—right or wrong—will continue to be a focus in today's schools. Our goal is to suggest an approach that honors students as learners, teachers as facilitators, and technology as an external implement that enhances cognition, particularly in areas of reading and writing.

A view of technology as predominantly a tutor and a communicator of information fails to acknowledge that students are active constructors of knowledge (Duffy & Jonassen, 1992). When students use technology to access information, analyze it, interpret it, and represent it in a new way, the computer becomes a conduit for the construction of knowledge, rather than merely a tutor. Jonassen and Reeves (1996) suggested the need for an "intellectual partnership" between learners and various cognitive tools, including the computer (p. 696). Students use technology to support their learning endeavors. The technology is not the focus of the learning, but it provides an essential vehicle for getting to the destination. Learning should drive the technology, not vice versa (Wepner, Valmont, & Thurlow, 2000). The inquiry—what the student wants to learn—provides the fuel for the vehicle. Without fuel, the vehicle is useless.

Inquiry-based learning is not new; however, the availability of technology to support the process provides a key element. At its most simplistic level, technology allows students to organize and edit their projects more easily. At a more complex level, technology allows students

to communicate with experts around the world, to access information from a vast array of resources, and to create high-quality presentations that combine text, sound, and visual images in ways that lead to what may be called "new literacies" (Leu, 2001).

Of course, information on the Internet is often inaccurate. However, teachers can use a "recommender system" to learn the quality of information on the Web. Recommender systems represent an emerging Internet technology that operates on the principle of "social information filtering." In essence, this approach provides word-of-mouth opinions and recommendations from trusted sources. For example, if you wanted to try a new restaurant, you might ask friends or look at a restaurant guide. This same premise applies to professional information filtering. A recommender system can provide opinions about websites by teachers from around the country or around the world who are participating in the construction of the system. For instance, a group of educators may form to provide recommendations on a particular topic (e.g., information on the Holocaust) or for a certain grade level (e.g., good websites for third graders). This at least lets a teacher know that particular materials or sites are deemed to be of high quality and usability by the educators participating in the group. An example of a recommender system can be found at <http://it-edtech.ed.usu.edu/alterredvista>.

Technology also encourages students to think differently about school. Access to technology makes school seem more "real world" to the students and consequently, their learning pushes the boundaries of the traditional school curriculum. Students are no longer limited by the materials available in their school or local community, nor are they confined to studying topics presented in their science or social studies textbooks. Instead, they can use these as starting points from which to extend and refine their explorations. As a teacher with 8 years of experience using inquiry learning noted,

When I need information for something I'm doing—for instance preparing a lesson—I might use the phone to confer with an expert, I might use the Internet to see what other teachers have done, I might go to the university library, I might create a database on the computer with relevant documents, I might use PowerPoint to create transparencies. Giving kids access to these same experiences and resources makes learn-

ing more real to them. It's not just an exercise done for a grade. It is a meaningful task with a purpose and an outcome.

Urban inquiry-based programs: Intellectual partnerships in action

We provide here brief descriptions of two university-sponsored, inquiry-based programs we have been involved with during the past 3 years. Over 100 7- to 15-year-old urban students participated in these programs. In both programs, children worked with adults to explore topics of interest using the frameworks outlined earlier, based on work by Grabe and Grabe (2000) and Short, Harste, and Burke (1996). These two projects demonstrate how technology-enhanced inquiry evolves differently depending on circumstances, resources, and the children and teachers involved, illustrating, therefore, that there is no one way to do inquiry-based instruction.

The Extra Edge was a 5-week summer reading and writing program designed to help inner-city, middle school children who experienced difficulty with reading and writing, were not very motivated to achieve in school, and were in danger of being retained in eighth grade. The specific instructional components of The Extra Edge focused on the following:

- Comprehension and critical thinking
- Word analysis and vocabulary acquisition
- The writing process
- Writing as a response to reading

The program provided students with 4 hours of intense literacy instruction, 4 days a week. To sustain student motivation and achieve our literacy goals, teachers devoted 50% of their instructional time to teaching comprehension, word analysis, and writing with a fiction text that all the students studying the theme read. In addition to providing a forum for explicitly teaching reading and writing strategies and skills, the novel helped the students and teachers develop a common language and background to guide inquiry development and understand key concepts about the theme being studied.

The remaining 50% of instructional time was devoted to inquiry development where the students applied the literacy strategies and skills that they learned to read and interpret nonfiction texts, websites, and other reading materials. Students

were frequently reminded to use their word analysis and comprehension strategies while reading. Writing was used as a tool for communication with their intended audience and to clarify understanding during inquiry development, a time dedicated to generating questions to develop inquiries and creating projects for presentation night. Technology was primarily used during the inquiry development portion of the instruction.

Specific uses of technology to support the inquiry included data gathering (Internet searches, multimedia encyclopedias, online interviews, content-specific software packages), data management (notetaking, charts, graphs), and presentation (creating a brochure or other printed material, constructing a Web page, crafting a PowerPoint presentation).

In addition to working with their university partners, students worked with community partners from local museums, and other cultural and business entities. Input from local experts helped the students to deepen understandings of their topics. One of the most notable outcomes of The Extra Edge was the eagerness with which the students approached the design and completion of their projects for the final presentation night. The students were asked to create projects that explained their inquiries and what they learned to an audience of parents, peers, siblings, and a variety of adult visitors. They were to include an audio component, a visual component, and an audience participation component in their presentations.

The students quickly learned that PowerPoint presentations, word-processed documents on poster boards, computer graphics, and video made fulfilling the project requirements both easy and enjoyable. As they shared their projects with one another in the days before the presentation night, their conversations were flooded with ideas for using even more technology to improve their projects. For example, when the Internet technology group projected their website for the others to see, two boys in the aviation group decided to replace their poster boards with PowerPoint presentations. Additionally, a student who could not attend the presentation night decided to have his presentation videotaped after viewing a classmate's videotaped interview with a dolphin trainer. The inquiry-based format of The Extra Edge provided the students with a social learning opportunity that allowed them to motivate and learn from one another. The different forms of technology creat-

ed a “polished finish” to the projects that, for the students, generated an unexpected sense of pride in their work and impressed the audience.

The second inquiry program we discuss—the Learning By Association Project—is a collaboration that began 3 years ago between a university and an inner-city nonprofit social service agency. Students enrolled in a reading methods course meet on a weekly basis with children from the agency’s after-school program to create inquiry projects. The children participate on a voluntary basis and may reenroll each academic quarter. Partners work together for 8 weeks. On the final night, participants share their work with one another and with parents and teachers.

During the first year of this program, only 4 computers and a limited amount of software were available, Internet access was not. Because an average of 20 children signed up each academic quarter, they did not spend much time on the computer. They spent the majority of their time using print resources to research their topics. While students enjoyed the one-on-one attention from their university partners, and parents and teachers reported growth in their reading and writing abilities, the project products tended to resemble traditional school reports. Students had difficulty moving beyond “Here is what I learned about dogs.”

A federal grant allowed for the purchase of 17 computers, a digital video camera, a scanner, a color laserjet printer, and a DSL line for Internet access. Initially, the computers distracted students. During the 75-minute weekly session, students spent half of the time in the computer lab and the other half in another room working on project-related tasks. While they were in the computer lab, they wanted to explore Internet sites that had nothing to do with their topics. They read all of the advertising banners on each Web page. They wanted to use the cameras hooked up to each computer to see what friends across the room were doing. However, for most students the computers became less interesting as they became more engaged in their inquiries.

Twelve-year-old Juan had been a participant in the program for five academic quarters. According to his classroom teacher, he read approximately two grades below level and had particular difficulty with inferential comprehension. While waiting for his partner to arrive, Juan could be seen talking animatedly and rough-

housing with his friends in the hall. Once his university partner arrived, a shrug of the shoulders seemed to be Juan’s main method of communication. No matter how friendly and upbeat each of his partners were Juan remained quiet. He was not uncooperative, he just seemed hesitant. Other than suggesting the initial topic of sports, he tended to agree with whatever his partner suggested they do. On project presentation night, he preferred to hold the poster and have the university partner explain it to the audience. After each presentation night, Juan indicated that he had enjoyed working on his project and would be back next quarter.

During the academic quarter when the new computer lab opened, Juan began in his usual hesitant manner, and again he indicated that he wanted to do a sports-related inquiry. His tutor recommended that they work toward creating a PowerPoint presentation that included video clips and that perhaps after learning about a few sports, they could invent a new sport that they could teach to the other students in the program.

Juan continued to begin each session with one-word responses and shoulder shrugs, but he quickly became more lively. He wanted to show other students the websites he found. He asked if he could sign up for extra computer time to research his topic during the lab’s open access time slots. He carefully read printed materials and highlighted important information. He asked to use a dictionary so he could be sure he spelled things correctly in his written product. During the project presentation night, Juan narrated the PowerPoint presentation while his partner sat in a chair in the audience.

What made the difference for Juan? Was it the access to a wider variety of resources? Was it the lure of creating a flashy PowerPoint presentation? Was it the topic focus? Was it a combination of these factors? It is difficult to say. However, it is clear that technology helped Juan to learn more about his topic and to enhance his reading and writing abilities.

Access to technology experts is every bit as important as access to technology itself when implementing inquiry-based programs. In *The Extra Edge*, one of the themes was Internet technology. The students studying Internet technology decided to form a group inquiry on the experiences of the other students in the summer program, and created a website for their project.

Their inquiry became: How do we create a website that shows what all students have learned in the program? The program only had four computers with Internet access. The students were led by an outstanding teacher with much experience in language arts instruction but limited Internet and no Web design experience. We were extremely fortunate that the community mentor for Internet technology graciously provided us with a workspace and released one of his website specialists to assist the students and teacher in creating the website. Without this mentor's additional support, the teacher and students would have had to change their inquiry.

There were many incidents where those involved in the inquiry process had to be flexible and prepared with alternative resources when directing students' inquiries. One of the themes in the summer inquiry-based literacy program was art and architecture. The directors of the program, the teacher, and an artist-in-residence spent months selecting materials and planning field trips to guide students' inquiries primarily in architecture. Within the first week of the program, two girls dropped from the class and the three remaining boys became discipline problems. After a heartfelt discussion with the boys about their behavior, we learned that the boys had a true passion for drawing and did not see architecture as having anything to do with art or their interests for that matter. We immediately signed out books on drawing and purchased sketch pads and other art supplies. Instead of the already-scheduled architectural walking-tour field trips, the artist-in-residence and the teacher booked studio time at the university and scheduled walks to observe urban life. The group's inquiries focused on techniques for improving their sketching and painting and using writing as a means for sharing their discoveries on project presentation night. When the boys' teacher the previous school year came to project night, she was in awe about the amount of writing and the skill with which the students led the audience through simple sketching techniques.

Lessons learned

In addition to what we learned about inquiry, literacy, and technology that has already been discussed, we offer the following ABCs of observations and lessons learned as a result of our experiences with inquiry-based learning:

- *A: Approach with enthusiasm.* Learners will notice the teacher's excitement immediately. The teacher needs to communicate, "This is going to be a different way of doing things—I'm not an expert on all of the topics that we'll be exploring. We'll be learning together and that will be so exciting!" The teacher's modeling of the inquiry process will speak volumes to the students.
- *B: Beware of hyperleaping.* The computer seems to bring out the attention deficit in all of us. Students need to learn how to narrow their topic so that their searches can be focused and fruitful. It is easy (and tempting) to get lost in cyberspace. A search that begins with the rain forests can hyper-leap to the latest in vacation clothes. Therefore, the importance of well-formulated questions again becomes key. Students can self-check by periodically asking, "Is this information even remotely connected to any of my questions?" If the answer is no, then a quick click of the "Back" button is in order.
- *C: Critical reading skills.* Though always important, critical reading skills are more necessary than ever. Students must learn how to judge the accuracy and legitimacy of their sources in ways they may not have used in the past. Gone are the days when the majority of information for a project comes from an encyclopedia or a textbook. There are thousands of websites related to environmental issues. Students need to know how to determine which would be most useful—the site from the Sierra Club or someone's personal homepage. Just because a site is listed in the first set of hits that appear on the search screen does not mean it is a legitimate or useful site. A tobacco company might have paid to make sure that their site was in the top 20 for particular searches. Would this be the most bias-free place to look for information about smoking? Students must question what they find on the Internet. Students also need to learn how to skim and scan so that they can quickly determine whether a particular website relates to their specific inquiry. Becoming adept at skimming and scanning helps them to determine quickly if the website is written at a "kid friendly"

level. Finally, students must become adept at comparing and contrasting information from different sources. These intertextual connections are key in developing critical reading. For example, as the students in The Extra Edge gained baseline knowledge about their inquiries, they frequently found conflicting information in different sources. For many of them, this was an exciting but confusing experience because they never thought of challenging the accuracy of written material or experts for that matter. This became a teaching point as the teachers guided students in evaluating the credibility and accuracy of the Internet sites and reading materials as well as the information learned from the community mentors.

- *D: Delve into topics while protecting the students.* Even the most innocent search on the Internet can lead to inappropriate material. Search engines such as AOL's Kids Only (<http://webcenter.search.aol.com/kids/>) and Yahooligans (<http://www.yahooligans.com>) can be effective filters. However, it is always good for the teacher to keep an eye on the computer screens when students are searching for material. Previewing and bookmarking appropriate sites prior to student searches may also prove to be safe and useful. Although this is more time consuming than using a search engine to filter inappropriate material, it provides the added advantage of narrowing student searches and using instructional time effectively.
- *E: Expand horizons.* It is natural for students to want to spend time on "fun" sites. The World Wrestling Federation site or the Pokémon site may have great appeal to students because of their familiarity with them. The teacher can assist in expanding the students' horizons by directing them to websites that relate specifically to their projects and that are presented in an engaging manner. Video clips, sound, and photos can all capture interest and hook students into exploring a particular topic in more depth. Web-based sources like <http://www.educationworld.com> or <http://discoveryschool.com/schrockguide> can

assist the teacher in finding relevant educational materials of this type.

- *F: Facilitate the process.* Perhaps the most important thing the teacher needs to do is to act as a facilitator. She or he must continuously discuss the project with the students, ask questions to keep the inquiry meaningful and focused, and monitor progress. The teacher initially is the one who pushes both the "Who Cares" and the "Do Something" aspects of the projects, but eventually, as the students become more adept at the process, these become habitual. Students must sometimes be reminded that the flashiest PowerPoint presentation complete with imported movie clips may not be as informative as another presentation. Teachers can monitor that the students are not spending inordinate amounts of time on the technical side of the presentation at the expense of the content.

Also, having 25 different inquiry-based projects easily becomes overwhelming to a teacher. She or he may decide to have the students select topics in groups, or the teacher may choose to facilitate a class project. (For recommendations of Internet-based projects, see Leu [2001], <http://edweb.sdsu.edu/webquest/webquest.html>, and <http://gsh.lightspan.com/pr/index.dfm>.)

- *G: Go for it.* Don't be intimidated by inquiry-based learning or the technology associated with it. Inquiry is a process, though not necessarily a linear one. Start at the end with an established idea for what to do with the information; begin with some stem questions or perspective questions to refine the seed of an idea; or jump in someplace in the middle.

Future of technology-enhanced inquiry-based instruction

Some school districts have made concerted efforts to provide teachers with technology and training in how to integrate it with instruction. The integration factor is probably the most important in determining whether technology will enhance or detract from learning goals. Salomon, Perkins, and Globerson (1991) pointed out, "No important impact can be expected when the same

old activity is carried out with a technology that makes it a bit faster or easier; the activity itself has to change" (p. 8). When teachers are willing to examine their beliefs about learning—to ask, "What does the technology allow me to do better, not just differently?"—student learning can be enhanced. School districts that have spent large amounts of money on hardware and software, but have neglected to encourage teachers to examine their own teaching and curricular beliefs and have failed to provide instruction in the possibilities for technology integration, are struggling to understand why they are not seeing changes in student outcomes. School districts that have not found the funds to purchase hardware, or that have had difficulty funding the necessary wiring and infrastructure needed to support large-scale technology initiatives, struggle with the fear that they are contributing to the creation of a society of haves and have nots.

Where will you go today?

With the technical resources available today, we can go literally anywhere without leaving our classrooms. We can take our students on a tour of the Egyptian pyramids. We can watch astronauts conducting science experiments in space through a live Internet video camera. We can follow a dogsled team through the Iditarod race. We can connect to experts around the world. We can access rare documents and archives. We can hear the voices and see the images of heroes who have long since departed this world. All of this can occur with the quick click of a few buttons.

Of course, virtual experiences should not be considered a replacement for actual experiences, but how many of us would otherwise ever have the opportunity to sail around the world with someone or participate in a discussion with a Nobel prize-winner? Technology provides a vehicle to take us through these experiences. We—the learners—provide the fuel. Our inquiries, our questions, our explorations determine the path of the journey and the ultimate destination. While the destination is important, an old Taoist saying reminds us that often, the journey is the reward (Deng, 1992).

Farwick Owens teaches at DePaul University (School of Education, 2320 N. Kenmore, Chicago, IL 60614-3250, USA). She may be reached by e-mail at rowens@depaul.edu. Hester and Teale teach at the University of Illinois at Chicago.

References

- Baum, S., Renzulli, J., & Hebert, T. (1994). Reversing underachievement: Stories of success. *Educational Leadership*, 52, 48–52.
- Cordes, C., & Miller, E. (Eds.). (2000). *Fool's gold: A critical look at computers in childhood*. College Park, MD: Alliance for Childhood.
- Deng, M.D. (1992). *365 Tao daily meditations*. San Francisco: Harper.
- Duffy, T.M., & Jonassen, D.H. (Eds.). (1992). *Constructivism and the technology of instruction: A conversation*. Hillsdale, NJ: Erlbaum.
- Grabe, M., & Grabe, C. (2000). *Integrating the Internet for meaningful learning*. Boston: Houghton Mifflin.
- Harvey, S. (1998). *Nonfiction matters: Reading, writing, and research in grades 3–8*. York, ME: Stenhouse.
- Jonassen, D., & Reeves, T. (1996). Learning with technology: Using computers as cognitive tools. In D.H. Jonassen & T.C. Reeves (Eds.), *Handbook of research for educational communications and technology: A project of the Association for Educational Communications and Technology* (pp. 693–719). New York: Macmillan.
- King, A. (1991). Effects of training in strategic questioning on children's problem-solving performance. *Journal of Experimental Education*, 61, 127–148.
- Leu, D. (2001). Exploring literacy on the Internet: Preparing students for new literacies in a global village. *The Reading Teacher*, 54, 568–572.
- Martinello, M.L., & Cook, G.E. (2000). *Interdisciplinary inquiry in teaching and learning* (2nd ed.). Upper Saddle River, NJ: Merrill.
- Owens, R.F. (1997). Lighting a fire: A case study of one multi-age, project-based, technology-supported classroom. Doctoral dissertation, University of Illinois at Chicago. *Dissertation Abstracts International*, 58(11), 4192A. University Microfilms No. ADG9815181.
- Rief, L. (1999). *Vision and voice: Extending the literacy spectrum*. Portsmouth, NH: Heinemann.
- Salomon, G., Perkins, D.N., & Globerson, T. (1991). Partners in cognition: Extending human intelligence with intelligent technologies. *Educational Researcher*, 20(3), 2–9.
- Short, K., Harste, J., & Burke, C. (1996). *Creating classrooms for authors and inquiries*. Portsmouth, NH: Heinemann.
- Short, K., Schroeder, J., Laird, J., Kauffman, G., Ferguson, M., & Crawford, K. (1996). *Learning together through inquiry: From Columbus to integrated curriculum*. York, ME: Stenhouse.
- Wepner, S.B., Valmont, W.J., & Thurlow, K. (Eds.). (2000). *Linking literacy and technology: A guide for K–8 classrooms*. Newark, DE: International Reading Association.
- Zajonc, B. (1985). A computer pedagogy? Questions concerning the new educational technology. In D. Sloan (Ed.), *The computer in education: A critical perspective* (pp. 1–39). New York: Teachers College Press.